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ABSTRACT

One approach to the use of socioeconomic indicators for analyzing rural development alternative strategies is presented in this paper. The underlying assumptions of such an analysis are discussed. Necessary analytic information include (1) data on rural opinions about each facet of the socioeconomic environment and selected socioeconomic characteristics of people possessing those opinions, and (2) data for the construction of socioeconomic indicators from such sources as the censuses of population, housing, agriculture, and manufacturing; statistical series from various state and Federal agencies; local newspapers; and local government agencies. Suggested procedures for the use of discriminant analysis are detailed. (PS)

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RURAL DEVELOPMENT ALTERNATIVE ANALYSIS THROUGH THE USE OF DISCRIMINANT FUNCTION AND SOCIOECONOMIC INDICATOR MATRICES*

by

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Introduction

The technological progress and farm structural changes which have occurred during the past several decades have caused a massive substitution of capital for labor and land in farming. The substitution has limited various socioeconomic opportunities for people in rural areas where the traditional local economy is based upon direct utilization of natural resources by reducing the number of people required to produce the basic supplies needed by society. Consequently, there has been heavy out-migration from rural areas resulting in an abnormal geographic distribution of various human and man-made resources.[1/] This inequitable distribution has created a great concern for rural development which is supposed to correct the imbalance. For example, the Congressional activities of the 92nd Congress in 1971 included consideration of more than 50 bills dealing with rural problems. Rural development has also been given both theoretical and empirical emphases in various fields of the social sciences including economics, sociology, rural sociology, political science, home economics, agricultural economics, and anthropology.[2/] People in the underdeveloped or chronically depressed rural areas have also tried to improve their lot. They have attempted to obtain various resources from outside to facilitate rural development in the local area. Numberous instances of such effort by rural people is described in the data sources used for rural development research in Tennessee.[3/] Success, however, is often elusive, especially in rural areas with

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low income problems where impediments exist and alternative strategies for rural development are limited and sometimes difficult to identify. Thus, the study of the potential for rural development in underdeveloped or chronically depressed rural areas is an attractive challenge. As part of this potential, it is desirable to pinpoint those facets of the socioeconomic environment and the aggregate levels of the socioeconomic characteristics which need to be changed in order to facilitate (or obtain) desirable development.

The terms "community development," "social development," and "rural development" are defined in various ways by different authors within the same discipline and by authors in different disciplines. Part of the variation in emphases in different rural developmental programs seems to be introduced by such differences in definition.

Since there is no fully agreed upon definition, for present purposes, rural development is assumed to be anything which makes a contribution to the improvement in local socioeconomic or physical conditions and in the aggregate levels of various socioeconomic characteristics of rural people. If the adopted strategies for rural development were appropriate during the developmental process, changes in various facets of the local socioeconomic situation and in the aggregate levels of the characteristics toward preferred conditions would occur. The results of such changes would increase the capacity of various facets of the socioeconomic environment to provide benefits for the rural people thereby improving their opportunities to participate in various socioeconomic activities. Provision of such benefits would be reflected in an increase in measures of rural levels of living and in some improvement of the quality of rural life. The improvement could be expected to affect the general opinions of local people concerning various aspects of the rural socioeconomy.

The socioeconomic environment is here defined as including diverse facets such as local government, local politics, education, educational opportunities beyond high school, income and employment opportunities, law enforcement and safety protection, public utilities, churches and religious groups, recreational opportunities, agriculture and land use, welfare programs, provision of good housing, the physical setting, medical care and health services, roads and other transportation systems, and opportunities for the elderly and the young. Local people's opinions about recent changes in and the current quality of these facets of the socioeconomic environment will provide the basis for deciding which facets need to be changed to bring about rural development. (Hereafter the phrase facet of the socioeconomic environment will be abbreviated to FOSE.)

Perceptions of the conditions of the community will be influenced by one's position in the community and such position can be identified through various characteristics of that individual. The socioeconomic characteristics considered should include such things as age, educational achievement, income, occupational prestige, dependency, capability to work of family members, level of living, social participation, and leisure-time activities. Since the socioeconomic characteristics of the individual may interact with the environmental situation to produce favorable or unfavorable opinions about the various FOSE's, the approach to rural development might include attempts to change the aggregate levels of various socioeconomic characteristics which would improve the quality of some FOSE's and/or increase the capability of local people to take advantage of existing opportunities.

In addition to determining what needs to be changed, there is also the need for some indication of the amount of change needed. For this purpose there is a need for a "social indicator" for each of the FOSE's and for each of the aggregate levels of the socioeconomic characteristics of the people living in

the area (hereafter referred to as ALSC's). "A social indicator,...may be defined to be a statistic of direct normative interest which facilitate concise, comprehensive, and balanced judgments about the condition of major aspects of a society."[4/]

The value of a particular socioeconomic indicator rests upon its usefulness, meaningfulness, and helpfulness in terms of the implications which may be derived for program purposes, for comprehension of the actual quality of various phases of socioeconomic well-being at a particular point in time and the changes in the conditions of various FOSE's in the rural area during a specific period of time. The indicators should be constructed according to their implications and their levels of aggregation. In order to facilitate concise, comprehensive, balanced and informed judgments about the actual situations of major FOSE's and ALSC's, the sensitivity of each constructed indicator to change must be emphasized. Many published statistics are very important and their meanings easily understood but they cannot be considered as socioeconomic indicators if they do not show or explain the present condition of FOSE's, the various ALSC's, or the changes in either.

The terms "underdeveloped," "undeveloped," and "developed" differ from one another only in the rate of change in various FOSE's, in the ALSC's, and in the nature of changes in both during a particular period of time. Differences in the rates of change could be expected to influence the nature of the interactions between the various FOSE's and ALSC's. Such different interaction would influence the general perception of the local people concerning whether development in any degree had occurred or not in a particular area during a specific period of time.

It is difficult to evaluate the speeds and the nature of changes intuitively and immediately from a distance. Indicators can assist in making such evaluations. From the indicators it would be possible to determine the present condition of a particular FOSE or ALSC and to obtain an indication of the magnitude of the changes needed.

"A social report with a set of social indicators could not only satisfy our curiosity about how well we are doing, but it could also improve public policy making in at least two ways. First, it could give social problems more visibility and thus make possible more informed judgments about national priorities. Second, by providing insight into how different measures of national well-being are changing, it might ultimately make possible a better evaluation of what public programs are accomplishing."[5/]

From the above, it is clear that socioeconomic indicators are very important. They help us to understand the present situations of various FOSE's, the current ALSC's of people in the area, as well as the rates of change in both. In addition, such indicators can help us to determine how strong proposed policies need to be for achieving rural development. They may also serve as a means of ascertaining the effectiveness of public programs. Although various economic statistics have provided a concrete basis for analysis of the economic facets of the society, there is still a need for more basic measures (indicators) of socioeconomic well-being. While a great deal of effort is going into the development of socioeconomic indicators, few authors have devoted much attention to how such indicators as they have developed may be utilized for policy purposes. This paper presents one approach to how indicators can be used in analyzing rural development alternative strategies. A number of assumptions must be made to permit this type of analysis.

Assumptions

First, it is assumed that there are some interactional relationships among individuals' socioeconomic characteristics and their general opinions regarding the nature of changes in and the present situations of various FOSE's in the rural areas. It is also assumed that these relationships are subject to analysis. Population size is one characteristic that is known to be related to virtually every institutional arrangement and population characteristic. Since censuses of population are normally taken at ten-year intervals, change in population size in a given area may be assumed to be at a constant instantaneous rate of growth during a specific decade even though it may be known that there probably were slight fluctuations. Following this pattern, each FOSE and the related ALSC's will also be assumed to have been changing at their own constant rates of change during a specific period time without any change in the external influences which may affect all of them.

A second major assumption is that the general opinions of rural people concerning each FOSE are reflections of the interaction between their own characteristics and the corresponding facet. The actual condition of each FOSE is invariable at a given point in time, but the rural people's opinions regarding that FOSE may vary from one individual to another. Such variations arise from the fact that each individual's socioeconomic characteristics differ from those of each other individual and the influence of such differences causes variations in the amount of benefits derived from that particular FOSE. Individuals' characteristics will also affect their knowledge with regard to the present actual condition of and the change in each FOSE during a specific period. The variations in their knowledge level among individuals and in the amount of benefits received will result in part from their having differing

criteria for evaluating the changes that have occurred and the current quality of the situations. Their knowledge level about each FOSE is also due to the effect of interaction between their socioeconomic characteristics and the corresponding FOSE.

All FOSE's in a given area are interacting and/or associated with the ALSC's for the entire population in that area at a particular point in time. The third major assumption then is that the change in every FOSE and the changes in the related ALSC's are associated with each other in a given area during a specific period of time. Thus, it is also assumed that there is a similarity in the existence of interactional relationships between each FOSE and its related characteristics at the micro and aggregate levels even though the degree of the relationship may differ on the two levels. The micro level referred to is the relationships between the individual's opinions about each FOSE and the characteristics of that individual. The micro relationship may be found or pinpointed from cross-sectional analysis of data obtained by interview. The macro relationship refers to the association of the ALSC's with their related FOSE's. Such association has long-run implication. It involves the time dimension. In some instances, researchers have assumed that the parameters linking macro and micro relationships are the same, but in the present analysis procedure, we do not make this assumption.

The fourth major assumption is that the greater the improvement in each FOSE, the larger would be the number of local people who would obtain benefits and/or the greater would be the amount of benefits derived by each person with the result that a greater proportion of people would give a "high" rating for the quality of that FOSE and would feel that it had "improved" during a specific period of time. It can be assumed that the reverse relationship also holds. That is, that the greater the deterioration of each FOSE the smaller would be

the number of rural people obtaining benefits and/or the smaller the amount of benefits which each person could get. Such a trend could be expected to increase the degree of disappointment of rural people with the result that there would be an increase in the proportion of people giving that FOSE a low rating and feeling that it had gotten "worse" during a specific period of time. In other words, the greater the change in each FOSE, the more congruent will be the general opinions regarding that FOSE. If this assumption is correct, the changes in various FOSE's during a particular period of time and their present situation can be determined by the general opinions of rural people about them. In addition, the general opinions of rural residents can be assumed to give appropriate directions for rural development even though the criteria upon which local people base their opinions may change with the passage of time.

Data Needed for the Suggested Research Procedure

The data required for this kind of analysis includes the following:

(1) Data concerning the general opinions of rural people about each FOSE (including the nature of change in and the current situation of each) and selected socioeconomic characteristics of the people possessing those opinions.

(2) Data for the construction of socioeconomic indicators to be obtained from various sources such as the censuses of population and housing, agriculture, and manufacturing; statistical series from various state and federal agencies; local newspapers; and local government agencies.

The Suggested Procedures for Analysis (Research Method)

Percentage distributions for the general opinions concerning the nature of change in and the present quality of every FOSE in the local area will be calculated. More dramatic changes in and more extremes of quality of each FOSE will result in greater congruity of opinion concerning that FOSE. At the same time, variations in the calculated percentages for different opinions regarding each FOSE may be caused by random fluctuations in the sample selection process. Some determination will, therefore, need to be made as to the source of the differences in the percentages obtained. Null and alternative hypotheses will be set up and statistical tests of the null hypothesis will be conducted. The theoretical probability distribution for occurrences of the different opinions about each FOSE is not binomial but multinomial; therefore, normal, binomial, or student-t distributions are inappropriate for the statistical tests and we will rely on X^2-tests. The null hypothesis and alternative hypothesis will be as follows:

$H_o : r_1 = r_2 = \ldots\ldots\ldots\ldots = r_n$

H_a : at least one of the percentages is different from the others

The null hypothesis states that the responses are evenly distributed among the possible response categories. The alternative hypothesis is that the percentage for at least one of the response categories is either greater or smaller than for the other categories.

Through the calculation of percentages for the different opinions and the conducting of statistical tests concerning each FOSE, identification will be made of those FOSE's which are inadequate and/or need to be improved in the rural development process. Those on which a significant proportion of the population agrees that the condition is inadequate will be designated the areas needing attention for rural development.

The next step will be apply discriminant analysis*** using linear as well as nonlinear statistical function models. Tests will then be made for the significance of the influence of each variable included in each discriminant function to ascertain which of the socioeconomic characteristics are related to opinions about each FOSE.

If there is no appropriate indicator for a particular FOSE and/or the various ALSC's to be included in the study, reasonable indicators will have to be constructed. In order to be familiar with the present situation of each FOSE and the related ALSC's and the rates of change in both, indicators which have already been developed and those designed for the study will be utilized in the analysis.

Once the indicators have been selected or developed, the next step is how to utilize them in rural development alternative analysis. Due to the assumption that each ALSC or FOSE has changed at its own constant rate of change, therefore

$$Y_t = Y_o e^{rt} \quad \text{.....(1)}$$

where Y_t is the magnitude of socioeconomic indicator for the ALSC or the FOSE at point t in time. Y_o is the initial value of the indicator, and r is the constant rate of change of the indicator. If the logarithms of both sides of equation (1) are taken, then

$$\ln Y_t = \ln Y_o + rt$$

$$r = \frac{\ln Y_t - \ln Y_o}{t} \quad \text{.....(2)}$$

Although the change in ALSC or in any FOSE has never been as perfectly smooth as in the equation (1), equation (2) will give a good approximation of the constant rate of change. If one year is taken as unit of time, then r will be the estimate of annual rate of change in any ALSC or any FOSE concerned

during the particular period of time. This assumes that there is no change in external socioeconomic forces which would affect the relationship, and that all of the socioeconomic variables in a socioeconomic system will continue to change at their previous constant rates of change.

If we find an interactional relationship or association existing between each FOSE and some ALSC's, then even though we are unable to evaluate the relationship in a quantitative sense by means of discriminant analysis, we can still obtain some idea of the responsiveness between them from the change rate matrix. The condition here is that the other related ALSC's or the related FOSE's are not held at any constant level but that they keep the same relative rates of change as all of the related socioeconomic variables concerned.

For example, suppose that there exists a relationship or association between one FOSE and one ALSC ($Y_{1,t}$, $Y_{2,t}$) and that there is no other relationship between either of these and any other socioeconomic variable. Considering the two variable cases first, if they have different constant rates of change (r_1, r_2) during the study period, then

$$Y_{1,t} = Y_{1,0}e^{r_1 t} \quad \text{.....(3)}$$

$$Y_{2,t} = Y_{2,0}e^{r_2 t} \quad \text{.....(4)}$$

$$Y_{1,t}Y_{2,t} = \frac{dY_{1,t}}{dY_{2,t}} \cdot \frac{Y_{2,t}}{Y_{1,t}} = \frac{dY_{1,t}/dt}{dY_{2,t}/dt} \cdot \frac{Y_{2,t}}{Y_{1,t}} \quad \text{.....(5)}$$

$$\frac{dY_{1,t}}{dt} = r_1 Y_{1,0}e^{r_1 t} \quad \text{.....(6)}$$

$$\frac{dY_{2,t}}{dt} = r_2 Y_{2,0}e^{r_1 t} \quad \text{.....(7)}$$

where $Y_{1,0}$ is the initial level of the FOSE and $Y_{2,0}$ is that of the related ALSC.

Now substituting equations (3), (4), (6), and (7) into equation (5),

$$\eta_{Y_{1,t}Y_{2,t}} = \frac{r_1 Y_{1,0} e^{r_1 t}}{r_2 Y_{2,0} e^{r_2 t}} \cdot \frac{Y_{2,0} e^{r_2 t}}{Y_{1,0} e^{r_1 t}}$$

$$= \frac{r_1}{r_2} \quad \text{.....(8)}$$

If the above supposition is not true, then equation (8) will show that as Y_2 changes at 1% of rate of change, Y_1 will change at r_1/r_2% of rate of change under the condition that all of the other related socioeconomic variables are changing at their own constant relative rates of change.

The above equations are concerned with only one or two variables in the socioeconomic system, so we must switch to a matrix approach to deal with more than two variables in the system.

Suppose we have a matrix of order nx (m+1) such as follows:

$$S = \begin{bmatrix} y_1 & x_1 & x_2 & \cdots\cdots & x_m \\ y_2 & x_1 & x_2 & \cdots\cdots & x_m \\ y_3 & x_1 & 0 & \cdots\cdots & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & 0 & \cdot & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & \cdot & 0 & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & 0 & \cdot & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ \cdot & \cdot & \cdot & & \cdot \\ y_n & \cdot & \cdot & \cdots\cdots & \cdot \end{bmatrix} \quad \text{.....(9)}$$

where y_i is an indicator for the ith FOSE and x_j is the indicator for the j-th ALSC. If there does not exist any interactional relationship between the ith FOSE and the jth ALSC, then the i, (j+1)th element in the matrix will be zero. This kind of matrix may be defined as a socioeconomic indicator matrix which

shows the entire socioeconomic conditions for its corresponding rural area at a given point in time and the existence of the interactional relationships among all FOSE's and ALSC's in the entire socioeconomic system. If we are able to obtain data for constructing two matrices, one for the initial point in the study period and the other for the final point in the period, then

$$\frac{\ln S_f - \ln S_i}{t} = R \quad \text{.....(10)}$$

where S_i is the indicator matrix for the socioeconomic system at the initial point and S_f is the matrix for the system at the final point. R may be called rate of change matrix [see equation (11)]. This is a matrix of order nx (m+1) and consists of the rates of change in various FOSE's (α_i) on the first column as well as the rates of change in the ALSC's (β_j) on all of the other columns.

$$R = \begin{bmatrix} \alpha_1 & \beta_1 & \beta_2 & \cdots \\ \alpha_2 & \beta_1 & \beta_2 & \cdots \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & 0 & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & 0 & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & 0 & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \alpha_n & \cdot & \cdot & \cdot \end{bmatrix} \quad \text{.....(11)}$$

If both sides of equation (11) are divided by k, then

$$\frac{R}{k} = \begin{bmatrix} \frac{\alpha_1}{k} & \frac{\beta_1}{k} & \frac{\beta_2}{k} & \cdots\cdots \\ \frac{\alpha_2}{k} & \frac{\beta_1}{k} & \frac{\beta_2}{k} & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \cdot & 0 & \cdot & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \cdot & \cdot & 0 & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \cdot & \cdot & \cdot & \cdots\cdots \\ \frac{\alpha_n}{k} & \cdot & \cdot & \cdots\cdots \end{bmatrix} \quad \cdots\cdots\cdots\

This vector shows that in order to raise 1% of the ith ALSC, $\frac{\alpha_i}{\beta_i}$% of the level of jth FOSE, the percentages of the related ALSC's will have to be changed. Again assuming that without change in the external influences, the various FOSE's and their related ALSC's will keep the same relative rates of change as previous. This vector may be called the j-th row responsiveness vector for the i-th ALSC.

If we pick the first column of matrix (13) and substitute zero for the elements which are corresponding to zero elements on the (i+1)th column of the matrix, then we obtain a new vector (15). This vector shows that in order to increase 1% of the i-th ALSC, the percentage of its related FOSE's must be changed if the "developmental path" is the same as the previous one; i.e., the relative rates of change in its related socioeconomic variables keep constant. Since it is very difficult to find substitution or complementary relationships between two FOSE's, between one FOSE and one ALSC, and between two ALSC's in a quantitative sense, we are only able to utilize matrices (14) and (15) to deal with the improvement of any ALSC. The vector (15) has a policy implication in terms of improvement in the related FOSE's for the improvement of the ith ALSC. It may be called the column responsiveness vector for the i-th ALSC.

$$\begin{bmatrix} \frac{\alpha_1}{\beta_i} \\ \frac{\alpha_2}{\beta_i} \\ \vdots \\ 0 \\ \vdots \\ 0 \\ \vdots \\ \frac{\alpha_n}{\beta_i} \end{bmatrix} \quad \ldots\ldots\ldots\

If $k = \alpha_j$, then vector (14) becomes

$$\left[1, \frac{\beta_1}{\alpha_j} \ldots 0 \ldots \frac{\beta_i}{\alpha_j} \ldots 0 \ldots \frac{\beta_m}{\alpha_j}\right] \quad \ldots\ldots(16)$$

The above vector shows that in order to raise 1% of the jth FOSE, the percentages of its related ALSC's have to be changed if all of the variables in the socio-economic system follow the previous change pattern in the system. At present, we are unable to obtain a vector corresponding to vector (15) for the improvement of the jth FOSE, since there is still no simultaneous discriminant function method available for analysis, and we cannot use a single equation statistical model to identify the existence of the interactional relationships among the FOSE's in the system.

Suppose now we want to raise the ith ALSC from x_i to X_i in a year, then

$$R_i = \ln X_i - \ln x_i \quad \ldots\ldots(17)$$

where x_i is the level of the ith ALSC at point t in time and X_i is the desired level of the ALSC at point (t+1) in time and R_i is the rate of change in the i-th ALSC needed during the year. The desired level of the ith ALSC, X_i, has to be determined by the extreme of average of the ith socioeconomic characteristic for those rural people who rated each FOSE "very good" or "good." In order to change the i-th ALSC from x_i to X_i during the year, the h-th ALSC or FOSE has to be changed according to the following percentage under the assumption that all of the other related socioeconomic variables are changing at their own constant relative rates of change:

$$R_h = \frac{\beta_h}{\beta_i} R_i \quad \ldots\ldots(18)$$

If we show the relationships of equation (18) in terms of vector notation, then the vector corresponding to vector (14) will be as follows:

$$\left[\frac{\alpha_j}{\beta_i} R_i, \frac{\beta_1}{\beta_i} R_i \ldots 0 \ldots R_i \ldots \frac{\beta_m}{\beta_i} R_i\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (19)$$

The vector (19) is equal to the product of the vector (14) and R_i.

If the assumption that any ALSC or the FOSE has changed at its own constant rate of change without change in any external influence is true, then the vector to show how much the rates of change in its related ALSC's or the FOSE needed to be modified by means of the additional policy implementation will be as follows, i.e., vector (19) minus a vector which is constructed by the j-th row of matrix (11):

$$\left[\frac{\alpha_j}{\beta_i} R_i - \alpha_j, \frac{\beta_1}{\beta_i} R_i - \beta_1, \ldots 0 \ldots R_i - \beta_i, \ldots \frac{\beta_m}{\beta_i} R_i - \beta_m\right]$$

$$= \left[\frac{\alpha_j (R_i - \beta_i)}{\beta_i}, \frac{\beta_1 (R_i - \beta_i)}{\beta_i}, \ldots R_i - \beta_i, \ldots \frac{\beta_m (R_i - \beta_i)}{\beta_i}\right]$$

$$= \frac{(R_i - \beta_i)}{\beta_i} \left[\alpha_j, \beta_1 \ldots 0 \ldots \beta_i \ldots \beta_m\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

If we want from its related institutional areas to change the ith ALSC from the current level to the desired level, then the product of $(R_i - \beta_i)$ and the vector (15) will show how much rate of change in each related socioeconomic variable needs to be raised or reduced by means of policy implementation under the assumption that the development path would be kept the same as the previous one if there is no change in the external influences.

Footnotes

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***At present, there are two kinds of canned programs available for discriminant analysis; one is the BMD program, and the other is the SAS program. BMD was developed under the assumption that the homogeniety of within covariance matrices exists. Sometimes the assumption is not true according to the computer output of the SAS canned program. If the assumption is not held, we cannot put confidence upon the results obtained from the BMD program. But the SAS program does not provide the complete set of statistics obtainable from discriminant analysis. Therefore, we hope in the near future some computer experts will develop more competent programs which will give a complete set of statistics possibly obtained from discriminant analysis.

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